



SATELLITE JOURNAL

Journal of the Radio Amateur Space Program

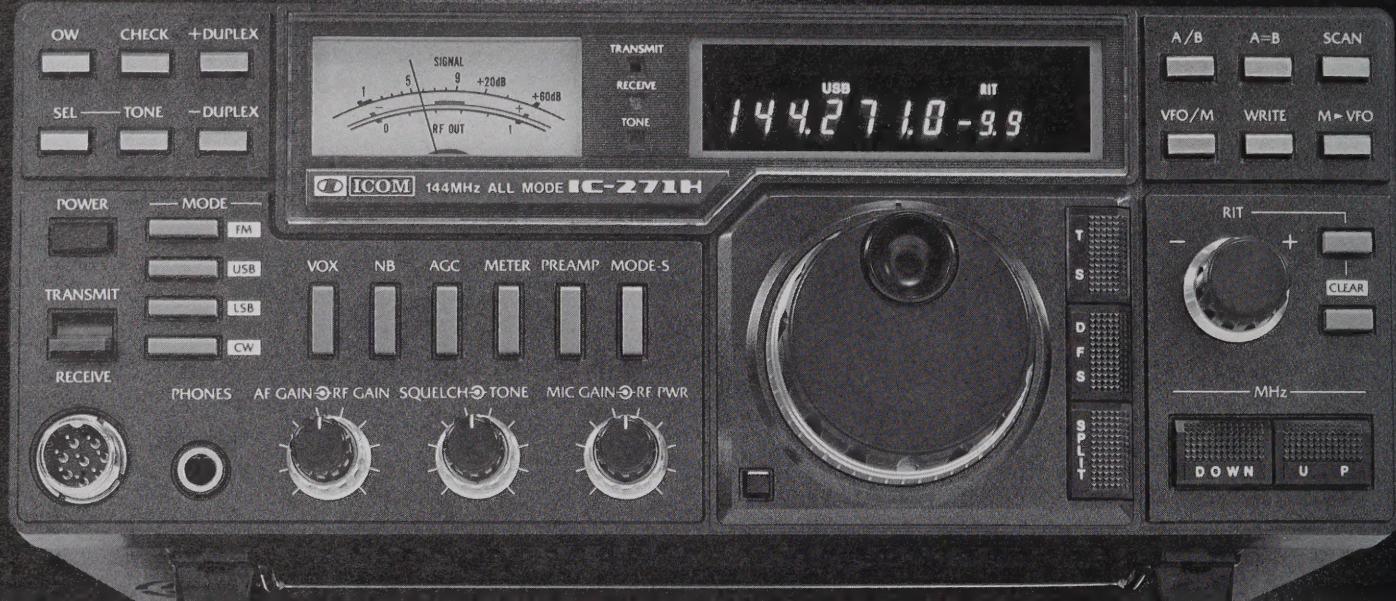
January-February 1985, No. 1



Published by AMSAT®—The Radio Amateur Satellite Corporation

ICOM VHF Transceiver

IC-271H



The Versatile 100 Watt 2 Meter Base System

For the ultimate in 2-meter communications, ICOM presents the IC-271H transceiver with a high dynamic range receiver and a 100 watt transmitter...And all the advanced functions of the latest CPU controlled radios.



Exceptional Standard Features:

- 143.800 - 148.199MHz, expandable for MARS operation
- 32 full-function Memories with lithium battery backup
- 100 Watts, fully adjustable on all modes
- Variable Tuning Steps, FM 5KHz and 1KHz; SSB 10Hz, 50Hz and 1KHz

- 32 built-in Subaudible Tones
- High Visibility Display
- S-Meter and Center Meter
- Scanning Systems Memories, Modes and Programmable Band

- IC-HM12 Microphone with Up/Down Scan
- 11 1/4" W x 4 3/8" H x 12 5/8" D

Optional Features. AG-25 switchable preamp, UT-155 CTCSS encoder/decoder (encoder is standard), IC-EX310 voice synthesizer, IC-SM8 two-cable desk mic and IC-SM6 desk mic. PLUS a variety of power supplies... IC-PS30 system power supply, IC-PS15 external or IC-PS35 internal power supplies.

The IC-271A. The 25 watt IC-271A has the same outstanding features as the IC-271H, including an internal power supply, IC-PS25.



See the IC-271A(H) and other fine ICOM equipment at your local ICOM dealer today.



ICOM

First in Communications



SATELLITE JOURNAL

Journal of the Radio Amateur Space Program

January-February 1985, No. 1

Staff

Editor: Harold Winard, KB2M
Publisher: William Lazzaro, N2CF

AMSAT Board of Directors

John Browning W6SP (Chairman), Tom Clark W3IWI, John Pronko W6XN, Jan King W3GEY, John Henry VE2VQ, Harry Yoneda JA1ANG, Vern Riportella WA2LQQ

AMSAT Officers

President: Vern Riportella, WA2LQQ
Exec. Vice Pres.: John Champa, K8OCL
VP. Engineering: Jan King, W3GEY
VP. Operations: John Champa, K8OCL
VP. Special Projects: Bill Brown, K9LF
VP. Manned Spacecraft Operations: Bill Tynan, W3XO
Asst. V.P., Eng.: Harold Price, NK6K
Asst. V.P., Eng.: Phil Karn, KA9Q
Asst. V.P., Adm.: Jim McKim, W0CY
Treasurer: Art Feller, KB4ZJ
Corporate Secretary: Martha Saragovitz

Headquarters Staff

General Manager/Executive Director: William Lazzaro, N2CF
Office Manager: Martha Saragovitz
Editorial Address: P.O. Box 575, Wharton, NJ 07885

Advertising Office: 850 Sligo Ave., Suite 601, Silver Spring, MD 20910 Phone: 301 589-6062

AMSAT: 850 Sligo Ave., Suite 601, Silver Spring, MD 20910 Phone: 301-589-6062 Telex: 248-566

"AMSAT SATELLITE JOURNAL (USPS 041-850) is published monthly except February, June, August, October for \$16 (inseparable from membership dues of \$24) by AMSAT 850 Sligo Ave., Suite 601, Silver Spring, MD 20910. Second-Class Postage Paid At Silver Spring, MD 20910 and at Additional Mailing Office. POSTMASTER: Send address changes to AMSAT SATELLITE JOURNAL, 850 Sligo Ave., Suite 601, Silver Spring, MD 20910."

Copyright © 1984 by AMSAT. Contents may be reproduced without specific permission provided proper credit is given, unless otherwise stated and copies are sent both to AMSAT and to the author. The opinions expressed are not necessarily those of AMSAT.

CONTENTS

Perspective: A New Beginning

Harold Winard

4

Starting Out: A Beginner's Perspective

Andy MacAllister

5

The Digital Front

Harold Price

6

Worldwide Satellite Operation

Ray Soifer

8

Thanks OSCAR 10

Orbit Sponsors

8

W6 Space Philosopher

John Browning

9

AMSAT News

10

de K2UBC

11

AMSAT-OSCAR 10 RTTY Format

13

On the cover: The 100' experimental L-band radar antenna at Sondre Stromfjord, Greenland. This striking photo taken by the light of the Aurora Borealis, was engraved on a plaque presented recently by AMSAT and the University of Surrey in memory of OX3FS. Dr. Bob Leonard, KD6DG, accepted the memorial on behalf of OX3FS's family and SRI International.

PERSPECTIVE

A New Beginning

Many of you have heard of the changes that were planned for AMSAT publications and now you have the opportunity to see the results. Although this is the first of a new style of publication, it certainly isn't a break with the past. AMSAT and those who bring you this publication hope that you will see a continuity with the past effort to bring you a balanced publication with something for every interest in the amateur satellite community.

Satellite Journal will contain many of the items you've seen in earlier publications, such as information from around the world, orbital elements, AMSAT news, etc. It will also have some new columns plus a greater emphasis on information for the satellite enthusiast just starting out.

The change has been brought about, in great measure, by the costs of producing a publication such as *Orbit*. The glossy paper and color cover are attractive but very expensive. Even though AMSAT has grown significantly in the last year, so too have the costs associated with preparing, printing, and mailing a magazine. Many within AMSAT felt that the monies spent for *Orbit*'s slick veneer could be better spent on projects of immediate importance, such as satellite construction.

Further, many AMSAT members indicated that they would continue to support the organization even if the magazine changed to a less expensive quality of paper and a trimmed size. Thus, we have a new publication—one we are sure you are going to like.

It would be useful for you to regard *Satellite Journal* as your publication. That is, the material presented here is as much about your interests in space and satellite communication as it is about the work of the satellite builders. You, the reader, are a key element in the AMSAT organization and in satellite communications. After all, the *raison d'être* . . . the reason AMSAT exists . . . is to provide communications for the radio amateur community. Without users, the great promise of amateur satellites would go unfulfilled. The satellites need users as much as they need sunlight for their solar cells. Without either, there would be no reason to hoist a large piece of metal into orbit around the earth.

As you look through this issue, you will see some new features. Starting Out, a column for the beginner by Andy MacAllister, WA5ZIB, will address some of the questions of the neophyte communicator. Andy is relying on you to help him define those topics that have been the bane of the newcomer. Antennas, converters, tracking, and a host of other subjects will be explained, defined, and, hopefully, made more meaningful to those developing their own satellite station. If you have a question, send it to Andy.

We are quite pleased to have Martin Davidoff join

Satellite Journal. Marty, K2UBC, is a well-known satellite expert and the author of the American Radio Relay League's very popular "Satellite Experimenter's Handbook." In his column, Marty will deal with a variety of subjects, including the technical details of satellite construction and operation.

Those who have had an opportunity to hear one of Harold Price's lectures know that along with his very entertaining talks comes an impressive wealth of information on digital communications. Harold, NK6K, is manager of the PACSAT project, a digital satellite that will pioneer that type of communications. In his column, Harold will keep you informed on the development of the satellite, packet protocols, and plans for gateway stations. Harold wears several hats, and is a key person in the packet radio community as well as one of the developers of the digital communications experiment (DCE) on board UoSAT-OSCAR-11. His column will touch on those topics too.

Continuing in his role as the Space Philosopher is John Browning, W6SP. John's column helps place AMSAT and satellite communications in perspective. Chairman of the AMSAT Board of Directors, John is a nationally recognized expert on satellite communications and a past director of the U.S. Air Force's satellite program.

In addition to columns, *Satellite Journal* will contain as many articles as space permits. Some will deal with operations and others with construction. Look for articles on new space propulsion systems, such as the plasma rocket, and ways to use the satellites for enhancing familiar techniques such as slow-scan television. We also will pass along information on commercial equipment and how to modify it for best performance. The only limit will be the room available to us in the magazine and the willingness of our readers to share their knowledge and experience with other readers.

We hope to share your views directly through the pages of *Satellite Journal*. If you have thoughts, opinions, or suggestions . . . carefully type them (double-spaced please) and send them to the editorial address shown on the masthead. We will include as many as space permits.

AMSAT and its members have some very exciting years just ahead. While PACSAT is being designed, Phase IIIC will be built. And while those satellites are prepared for launch, efforts will turn towards the challenging tasks of Phase IV—a satellite system providing 24-hour service for the world's radio amateurs. You can be part of it by belonging to AMSAT, contributing your skills, talents, and monies, and supporting this most important form of communication—*Satellite Journal*.

Harold Winard, KB2M

Starting Out: A Beginner's Guide

by Andy MacAllister, WA5ZIB*

Using the resources of our amateur radio satellites can be one of the most enjoyable ham radio activities you may ever find. This column hopefully will answer many of the questions newcomers to amateur satellites will have. Most satellite enthusiasts like to sample a little of everything available, but where does the newcomer begin? This column will hopefully answer many of your questions and give you the information you'll need to successfully communicate around the world through amateur satellites.

In this month's column I'll mention a few things about amateur satellites, just to get you started thinking and planning. In succeeding months you'll learn just how easy it is to set up and operate your own satellite ground station. You'll also find out ways to build that station inexpensively, sometimes using equipment you already have available or can obtain secondhand at a hamfest or swap meet.

Once you've assembled a station, you'll find that there is quite a selection of ham radio satellites available for experimental data collection, much as the UoSAT series, and communications, via the likes of OSCAR-10 and the Russian Radio Sport, or RS series satellites. For a good all-around guide, I'd suggest getting a copy of "The Satellite Experimenter's Handbook," by Martin Davidoff, K2UBC. It used to be difficult gathering sufficient data on ham radio satellites to cover all interests without amassing a big pile of old magazine articles, various books, and obscure journals. With Martin's offering (published by the American Radio Relay League and available through AMSAT), there is a very good single-source for information. In many cases, the

book will guide you to other sources if the topic is even too specialized for it.

While you page through the sections of the satellite handbook, scanning the chapters on space-craft fundamentals, turn on your hand-held transceiver or other 2-meter radio and set it to 145.825 MHz. Soon you'll be able to hear either UoSAT-OSCAR-9 or its successor UoSAT-OSCAR-11. Both were built by the University of Surrey in England and you can easily hear their 2-meter beacons. I have had good results with a Regency HRT-2 and its built-in whip antenna. Try listening for OSCAR-9 in the very early morning and mid-afternoon and OSCAR-11 in the late morning and late evening.

You will have many questions about what you hear while monitoring the satellite transmissions. For example, why did the signal fade in and out? Or why did it change frequency as it went overhead? Also, what do all those numbers mean and when will the satellite be back? You will also want to know how to better hear the satellite. These are just a few of the many things that will come to mind when you decide to set up a satellite station at home.

After whetting your appetite by listening to the 2-meter beacon signals from the UoSAT satellites, you will probably want to listen for the communication satellites, such as the RS series. Those satellites receive signals on 2 meters and transmit to the ground on 10 meters. Mode A, as it's called, is a combination of uplink and downlink signals that is easy to handle in a modestly equipped satellite station. In fact, some have even transmitted and received signals through those satellites while mobile.

To set up a Mode A station, you

need a receiver that covers 29.3 to 29.5 MHz. Although many hams already have an HF transceiver or receiver capable of picking up those frequencies, many rigs lack sensitivity at the top end of their range and a good preamplifier, such as the MOSFET design shown in the ARRL Handbook or available through commercial sources, can help a great deal.

An HF antenna is essential but need not be elaborate. For example, my ground-mounted vertical antenna has done the job nicely ever since Hurricane Alicia tore apart my 10-meter beam antenna a year and a half ago. In fact, I have been using a quarter-wave whip antenna along with a preamp and a communications receiver, all from my car, and have been able to monitor transmissions from the satellites. Even my regular broadcast-band car antenna has been sufficient to pull in signals from space.

For transmitting, I use a Kenwood TR-9000 2-meter radio. At home I use a 20-element twist antenna but in the car, a standard $\frac{5}{8}$ -wave whip antenna and a 90-W power amplifier works well. A good high-gain beam antenna will mean that less power will be required for the uplink signal. But remember, the RS series satellites are very sensitive and excessive power is not needed. As in much of ham radio, antennas are a wiser investment than power amplifiers.

Once you've assembled your ground station hardware, you will have to find the satellites and properly point your antennas in the right direction. Guesswork is adequate sometimes, such as for the UoSAT series, but for the other satellites, especially the low-earth-orbiting birds, such as the RS series, you will need greater accuracy. In my next column, I'll describe several ways to track satellites and predict when they will be available for use from your location.

If you have OSCAR-related questions, pass them on to me. Although I will not be able to respond to each individually, I will try to cover topics of general interest in this column.

*2310 Romayor Court
Pearland, TX 77581

The Digital Front

by Harold Price, NK6K*

A serious mistake has been made. The editors of our new magazine have signed me up to write a regular column. Whether or not THAT was a mistake remains to be seen. The error was that they said I could write on anything I wanted. That was a bad move on their part. I'm sure they had technical subjects in mind, maybe even digital subjects, but I wasn't listening closely. So we'll see how it goes, you and I, and we'll see if I'm back next month.

One final topic before we get down to work. The writing that sounds like someone talking was written by me. The parts that are stilted but grammatically faultless have been "corrected" by the editor. I, for one, have never seen the big difference between "To boldly go where no man has gone before" and "To go boldly where no man has gone before". By the way, if both of the preceding quotes were the same, one of them has been edited. If, on the other hand, they were different and you didn't notice, great! Read on.

Can we talk... digital?

You'll be seeing a lot of digital talk in these pages in the months to come. AMSAT is one of amateur radio's leaders in digital techniques and applications. So it is not surprising that a large number of those on the leading edge of amateur digital development are also members of AMSAT.

Digital radio and the amateur space program have already been closely associated. The most recent OSCAR satellites, UO-9, AO-10 and UO-11 rely on digital techniques for telemetry and control. A future AMSAT satellite, PACSAT, will use digital techniques for command and telemetry as well as for its user accessible communications mode. A joint JAMSAT/JRRL project, JAS-1, will carry a digital mode transponder. In addition, Phase III-C may also carry a digital transponder. UO-11 carries an experimental digital device as a precursor to PACSAT and JAS-1.

OSCAR-10 is also home to a growing number of digital users. Using the digital method called Packet Radio, a reasonable amount of "live" data has been passed around the world at a rate of 120 characters per second. Live data refers to meaningful information, not just test data. The most recent example is the transmission to ZL1AOX of an article from *Amateur Satellite Report* concerning the new OSCAR-10 schedule. Also transmitted to the New Zealand station were a few thousand characters worth of comments on Mode L scheduling by one of AMSAT's technical contributors, Ron Dunbar, W0PN.

Another recent packet experiment involved the linking of an HF station through OSCAR-10 to another station on 2-meter FM. The link consisted of seven packet radio controllers at five stations.

One of the things that makes this sort of experimentation possible is the adherence to a common

communications standard by ALL experimenters. In the packet radio world, this means use of the AX.25 packet protocol. The agreement by several separate groups of experimenters to use the same protocol in their development work was one of the best things to happen in the technical side of amateur radio in a long time. In fact, the word is getting out, worldwide, that if you buy, borrow, or build an AX.25 box, you have access to the rest of the packet radio world. The U.S., Canada, Brazil, Chile, Japan, England, West Germany, Switzerland, Norway, Singapore, Malaysia, Australia, New Zealand, South Africa, Costa Rica, the Netherlands, Italy, Bahrain, Iceland, Ascension Island, and others I'm sure I've missed, all have hams running the AX.25 protocol. With the growing number of satellite and HF gateway stations coming on line, a global data network can not be far off.

Since the agreement by a majority of experimenters to use the same protocol was reached, the growth of packet radio has been fast and furious. Because software, hardware, or procedures developed by one group can instantly be put to use by another, packet grew from less than 150 "bearded experimenters" before the agreement to close to 2000 after it. And packet continues to grow at a fast rate. More sources of packet hardware are expected to join the six current manufacturers later in 1985.

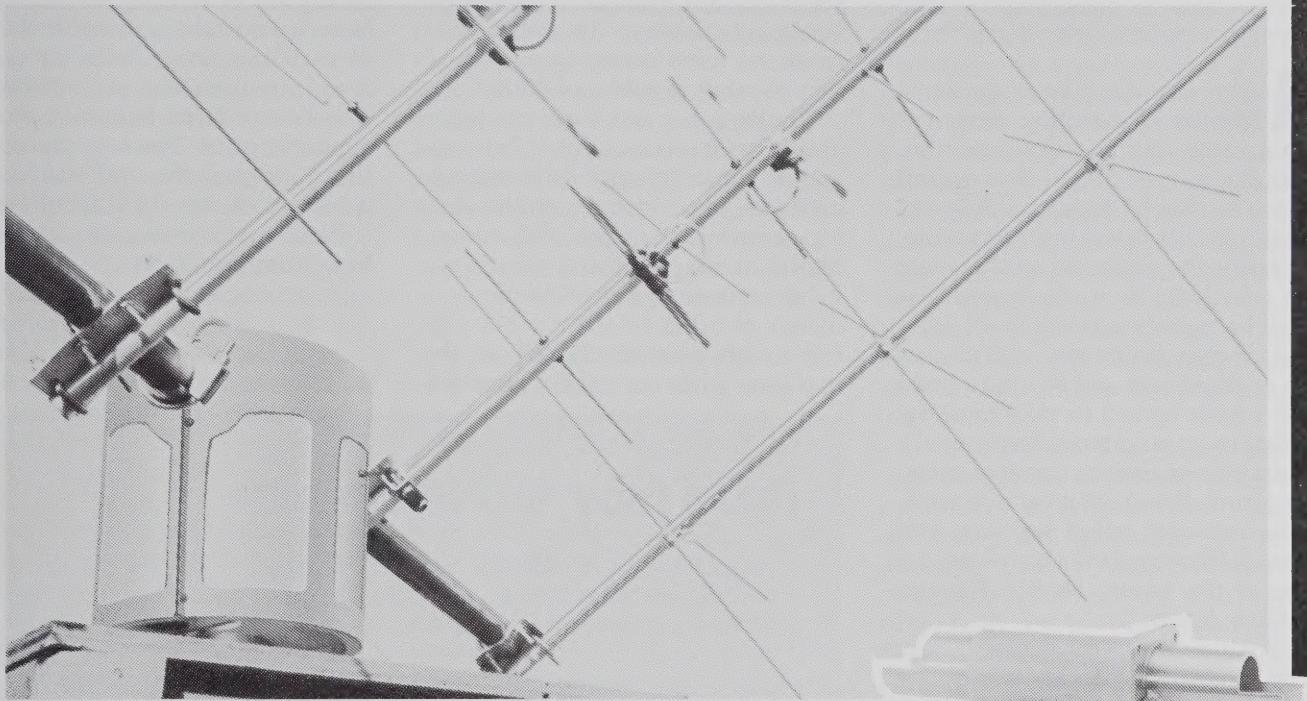
That is not to say that there is no room for further experimentation, or disagreement. There are other groups pursuing radically different paths. The most exciting of these is the SOFTNET protocol under development in Sweden. Elsewhere, work is beginning in the area of network protocols. Those protocols will be added to the base established by AX.25. As a matter of fact, the opening volleys have already been fired by the forces of so-called virtual circuits and the proponents of another networking technique, called datagrams. Meanwhile, other hams are working on file transfer and mail protocols.

International cooperation is growing as well. Amateurs from the UK and West Germany were present when the final AX.25 document was approved. Amateurs in Japan are producing packet equipment to run AX.25. The IARU has appointed the ARRL as its clearing house for information on packet radio. The satellite community is discussing the creation of an international technical committee to work on standards for satellite communications, including digital protocols.

Satellites and packet radio are two of the most interesting technical projects in amateur radio today. In the months to come I hope to make this column a forum for discussion of the mix of those two topics. See you next month.

*1211 Ford Avenue
Redondo Beach, CA 90278

NEW! OSCAR DR10 Dual Axis Rotor



As a leading manufacturer of precision motor drive systems, we believe the newly developed DR10 is the finest dual drive system for satellite antennas. To provide you the highest level of performance and convenience, the DR10 Dual Axis Rotor features:

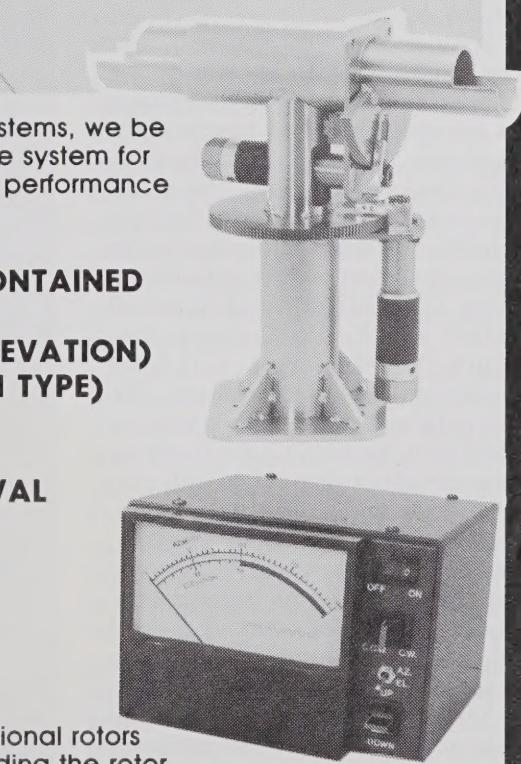
- **COMPACT CONTROL UNIT WITH SELF CONTAINED AC POWER SUPPLY**
- **SINGLE DUAL SCALE METER (AZIMUTH/ELEVATION)**
- **SINGLE 8 WIRE CONTROL CABLE (BELDEN TYPE)**
- **STANDARD TOWER TOP MOUNTING**
- **ACCEPTS 1½ INCH ANTENNA BOOM**
- **SERVICEABLE WITHOUT ANTENNA REMOVAL**
- **DYNAMIC SYSTEMS' HIGH TORQUE, PRECISION GEARMOTORS**

NOW AVAILABLE
for immediate delivery

Our DR10 will out-perform any combination of conventional rotors popularly used, and is supplied ready to mount, including the rotor, control unit, and all stainless steel mounting hardware. (less cable)

For immediate ordering information,
individuals and dealers call or write

612-441-4303



DYNAMIC SYSTEMS
19128 INDUSTRIAL BOULEVARD
ELK RIVER, MN 55330

Worldwide Satellite Operation

by Ray Soifer, W2RS*

After conducting *Orbit's* "Worldwide Satellite Activity" column so ably since its inception, Pat Gowen, G3IOR, has taken leave so that he may find the time to pursue his many interests, most notably the cause of world peace to which he is so dedicated. Pat will be greatly missed by all readers, and we know you will join us in wishing him and Norma 73 and 88. I have agreed to take over the column on an interim basis until a suitable permanent conductor can be found. If you are an active satellite operator, enjoy writing, and would like to give it a try, please let me or the editor, Harold Winard, KB2M, know.

With a "new" magazine comes the opportunity to try some new tricks, including the slight change in the title that may have caught your eye. This column belongs to you, the operator. Like the satellite itself, it is a vehicle through which you can communicate with other operators and potential operators. Like *QST*'s "World Above 50 MHz" and *Radio Communication*'s "4-2-70," this will be a reader-contributed column. We not only want to hear from you, we need to, or we won't have anything to write about. If you feel diffident or uneasy about writing for publication or writing in English, don't worry—just put your story into a simple letter to your conductor; we'll take what we get and edit it into a column of interest to readers.

Throughout the history of amateur radio, until the invention of the repeater, DX was "what it's all about." Man against nature, your station equipment and operating skills against the world. Farther was better. Over time, the pursuit of distance for its own sake evolved naturally into collection-type pursuits, such as DXCC and WAS. That emphasis on DX, on

competition, on the contact for its own sake still has an important place in terrestrial amateur radio, where contacts between stations still are made "under their own power." With repeaters, however (including AMSAT-OSCAR-10), the contact is made possible by the repeater, and much of the emphasis is shifted from the process of communication to its content—from the mere existence of a contact to what is said and done.

That's what we want to hear about most from you. Tell us about some of your interesting contacts, experiments, public service communication, QRP, amusing incidents, anything you think might interest a worldwide audience of other satellite users. Or, tell us about yourself. Where do you live, what do you do, how did

you happen to get into amateur radio and onto the satellite, what does satellite operation mean to you? Sharp, glossy black-and-white photographs would also be most welcome. We very much intend to continue G3IOR's emphasis upon worldwide activity, and hope to hear from users in all countries. In writing to us, please bear in mind the inevitable delays of publication—lists of calls heard, frequencies, etc., probably will be outdated before they can appear in print. The best places for those are probably bulletin transmissions or weekly DX bulletins.

Well, that's it for now. Hope to hear from you soon.

*60 Waldron Ave.
Glen Rock, NJ 07452, USA

Thanks Oscar 10 Orbit Sponsors

In each issue of *AMSAT Satellite Journal*, we'll list the additional names and call signs of those generous AMSAT supporters who have sponsored AMSAT-OSCAR-10 orbits.

Maury Hatfield, VK8OB	Jim Broaddus, K4RZB	W. D. Schulz, VE3ELD
Francis Absolonne, ON5RF	Nancy Fitz	Robert Aldrich, W0JVM
Richard Ruhl, WD5GLD	Lyle Mabbott, W7KMF	Charles Vannoy, W9WDD
Robert Strathy, WV4F	W. F. List, WB3HNP	John L. Hill, W0ZWW
M. D. Hill, KA4BYA	Gene Jacobson, WA7TAI	Don Gwynne, K5EVI
John Wasciuk, WA8TON	John D. Holden, VE3EP	Jerry Jordan, KA4DCH
Henry Killets, W2CFY	Sherman Hart, W5BLB	Dana Whitlow, K8YUM
Kenneth Evans, W9MBL	George Kesley, WT4X	Antonio Gibelli, I1KKU
Charles Beasley, WA6UBX	Gregory Chambers, WB9UHR	William McCaa, K0RZ
Garry Hess, K3SIW	Edwaltor Silva, PY6HL	Chris Lingen, SM7OH
Roy L. Brown, KE6J	Brad McCarter, VE3KQS	L. Phil Wicker, W4ACY
Carl Neme, K3VPZ	Stephen Butler, WB8UWK	David Whittle, N4FND
Tom Middleton, WB4CKY	W. Bill Conkel, W6DNG	Carl Lyster, WA4ADG
"Pete" Eldridge, WA4PLR	Thomas Calomiris, K3TC	Hugh Turnbull, W3ABC
James Mozley, W2BCH	Arthur Barlow	A. C. Keyl, WB4WRM
Samuel Goldstick	Steven Gomez, KE5O	Ronald Vanke, K8YAH
David King	Walter Rader, WA3DMF	Will Boyd, K4HMI
Joseph Brennan, KF6NO	John Browning, W6SP	R. Lee Hagan, K40ZQ
Ed Tanton	A. G. Courchene, W1SJS	George Tew, NC5Y
Danny Lewis	Leon Louis Pokorny, PY2ACM	Bruce Power, WD4HWO
Harry Przekop, Jr., WB9EDP	Paul Stewart, ZL2BPS	Don Warren, W8FQE
B. Lindholm	Frank Dulaney, N4JKH	Richard Ensign
James Grace, KA2AQV	Jay Miller, III, WA5WHN	Samuel Hevener, W8KBF
Jere Bruning, WA0UQA	Harold Price, NK6K	Al Algiers, W9HR
Tom Gentry	Terry Price, N6HBB	Don Murray, W4WJ
R. H. Prince	George Pearse, KA1DF	H. C. Knief, W2YTO
Andrew Deskur, KAIM	Ed Steeb, WA2RDE	John Conn, KA5FFX
Earl Whitt	Charles Pasquier, W5LWE	Dick Shaw, NF4H
Stan Cottrell, WA1NCV	Doug Varney, WAIUVP/6	Joseph Connery, Jr., WA1ZVA
Mike Scarella, WA5TWT	Ted Gorski, N9AWA	A. G. Wentzel, Jr., W2HX
Ronald Loy, W8GUS	Kenneth Kerwin, II, K6UXO	Dennis Pugh, K7VAY
Russell Moyer, W3JUZ	John Dolacko, WB8IYR	John Klingelhoeffer, WB4LNM
William Werenski, W1CJK	E. Suryadarma, YB0BZZ	Lee Barnett, KB4DVN
Barry Baines, WD4ASW		Robert Willis, K2GLS

W6 Space Philosopher

by John Browning, W6SP, Chairman of the Board*

All radio amateurs have a keen perception of the opinions of their fellows because they spend nearly all of their operating time merely listening. That fact is completely substantiated by frequent on-the-air comments from typical operators, particularly DXers, who repeatedly assure us they spend much more time listening than sending. If they didn't, our frequencies would probably become quite crowded and we wouldn't get along so well!

Some of us have discovered that we can double our listening capacity by taking advantage of a physical phenomenon sometimes called the "cocktail-party effect." Humans were cleverly designed with redundant ears that are wired into opposite sides of the brain. If two conversations are mixed in a speaker or headset, deriving intelligence from either becomes difficult. The conversations interfere with each other. However, by using stereo headphones, with the earpieces connected to separate receivers, we can easily comprehend two different conversations simultaneously.

For several years, it has been my practice to spend the hour just after local sunrise operating on the 20-meter band. While engaged with the likes of JA1ANG, KH6OD, F8ZF, 9V1OI, ZS5PG, ZF1AF, KA4JFO, AD6P, and W6ZN (14.240 MHz, upper sideband, left ear), I have been able to monitor W6CG, W6ELT, W6HEW, W6KAG, W6YVO, N6DD, and, on special occasions, even KL7GRF (144.144 MHz, upper sideband, right ear). For those puzzled by the apparent unusual extent of 2-meter propagation, it should be noted that John, KL7GRF, lives in Long Beach, California. The 20-meter group gathers daily to resolve the world's major problems. The 2-meter operators restrict their chatting to the specific subject of satellite activity, except for an occasional reference to computers.

Being constrained by a non-re-

dundant tongue, I have never developed the skills required to enter into discussions on both channels simultaneously. There is also some uncertainty regarding which portion of the brain my tongue is connected to. However, I take advantage of my capability to eavesdrop on the local-area satellite users. As a result, I have derived an independent perception of their various inclinations (pun intended).

"Perception" can be defined as "a mental image based on experience." Sometimes perceptions are distorted. At the start of this new year, a leading metropolitan newspaper reports "disappointing" holiday sales nationwide. The business page confirms a drop in the price of a major toy retailer's stock as a result of unrealized marketing objectives. His sales are up "only" 16-percent over the previous year whereas he had anticipated a 30-percent increase. It seems obvious that basing hopes on wild anticipation can guarantee disappointment.

Your AMSAT Board of Directors is composed of typically perceptive human beings who are sometimes inclined to be over-optimistic. However, as we sat down for our November 1984 meeting, we were forced to meet realism head-on. In the past, we had anticipated a dramatic growth in membership after the deployment of AMSAT-OSCAR-10, our first successful, high-altitude satellite. Increased membership, we thought, would expand our influence and permit our publications to approach self-sufficiency. As the meeting got under way, we shared with each other our mutual disappointment in AMSAT progress during 1984. We had achieved "only" a 36-percent growth in membership for the 12-month period. As reality dawned, we noted that most organizations would consider a one-third annual expansion to be a major accomplishment. That realization led to a re-examination of other

long-term goals.

For several years we have struggled to build AMSAT into THE world-wide amateur satellite organization. Our Board has long been international in composition but we have been frustrated in our efforts to gain universal acceptance. As a result of language and cultural differences, as well as national pride, amateurs in many countries have preferred to independently develop their own satellites, space societies, and publications. Our most sensible and efficient approach is to accommodate that real-world situation. Perhaps we can conserve the energy that might be devoted to futile bureaucratic expansion efforts and redirect it to provide better service for those who, in the United States and abroad, clearly want to be a part of AMSAT.

In our attempts to understand the needs of our members, we have a tendency to talk too much and ask too many questions. By requesting "yes" or "no" answers to complex queries, we confuse everybody, including ourselves. What do our members want? The Directors certainly have a duty to learn about and represent their wishes. We also have a duty to examine carefully all of the available facts concerning important issues so that we can select proper courses of action. To do so, we must exercise our own judgment as to what best meets our organizational goals.

Highest priority will always go to the development and launch of successful and useful satellites. The key players in our AMSAT game remain the select few with the technical ability to create spacecraft. They are the modern equivalents of the proverbial kid who lived in a poor neighborhood but owned a football. He always got to define the rules and play in the game! He still was required to promote sufficient cooperation among his friends to make sure there was a game in which to play. And he even managed to continue playing after a capable neighbor suddenly produced a round, white object that he called "der Fussball."

* 6202 Lochvale Dr.
Rancho Palos Verdes, CA 90274

AMSAT NEWS

Capacity Crowd Hears Space Symposium, Annual Meeting

More than 200 persons attended the 1984 AMSAT Annual Membership Meeting and Space Symposium last November 10th in Los Angeles' Amfac Hotel. The day-long program featured speakers from around the world and drew attendees from as far as Australia (VK5AGR), Tasmania (VK7PF), New Zealand (ZL1AOX), England (G3YJO and G8NOB) and Japan (JA1ANG). The meeting was organized by the team of W6SP, AD6P and N6DD.

The technical session included talks by Al Dayton, KA4JFO, who described advanced gateway concepts and a plan whereby a group of amateur radio clubs and organizations could purchase a geosynchronous satellite, complete with several C-band transponders, and give access to the average ham through numerous gateway stations. The gateways, or teleports would serve large communities of amateurs, according to Al.

AMSAT Director Harry Yoneda, JA1ANG, presented a preview of the JAS-1 satellite being built entirely in Japan by JARL and JAMSAT and scheduled for launch by NASDA, Japan's national space agency. Launched by the Japanese H1 launcher, JAS-1 is expected to have a 1500-km orbit inclined 50 degrees to the equator, according to JA1ANG.

ARRL Technical Department Manager Paul Rinaldo, W4RI, described progress in amplitude compandored sideband (ACSB) techniques. Paul described initial experiments performed recently at ARRL Headquarters. He also explained Project Companion, a joint ARRL-AMSAT-Project OSCAR effort designed to encourage the use of the spectrum-efficient ACSB technique on the ham bands. Paul's talk was supplemented by those of Jim Eagleson, WB6JNN, and Paul Shuch, N6TX, both of Project OSCAR. The two have been among the parade leaders in getting ACSB on the ham bands.

Bob Diersing, N5AHD, gave a presentation on "Computers and the Satellites." Bob focused on systems he has developed to track and decode telemetry from the UoSAT satellites.

A group from the World Space Foundation spoke on the Solar Sail Project and described plans for AMSAT participation in the venture. Those plans include an agreement between AMSAT and the World Space Foundation to explore means of cooperation in future projects.

A review of the latest happenings and progress on the PACSAT project was presented by Harold Price, NK6K, Wally Lindstruth, WA6JPR, Rick Fleeter, WA8VGK, and Phil Karn, KA9Q. Each described various aspects of the PACSAT program, including plans for special types of propulsion systems.

Martin Sweeting, G3YJO, UoSAT Program Manager summarized the status of both UoSAT-OSCARs 9 and 11. He said that both spacecraft were behaving well and that UO-11 had been well-stabilized, resulting in improved better link performance.

Tom Clark, W3IWI, explained some of the economic factors that determine what projects can be built and what expenses AMSAT absorbs in order to keep the organization running. Tom said that in round numbers AMSAT spends \$250,000 annually for all purposes.

Bill Tynan, W3XO, gave a progress report on future "Ham-In-Space" activities. Bill noted that approval of the joint ARRL-AMSAT proposal for W0ORE to fly a suite of amateur radio equipment was thought to be imminent.

Closing the technical program, WA2LQQ spoke of future advanced satellite projects. Rip claimed that an appraisal of amateur radio indicates that the time may be right to begin serious consideration of a system of geosynchronous amateur radio satellites for continuous global coverage.

Included in the days activities was the presentation of awards. The first was a set of plaques in memory of the late Finn Steenstrup, OX3FS, who died last year in an accident at the SRI International L-band radar dish antenna in Greenland. Finn was the operator who picked up the faint signals from the ailing UoSAT-OSCAR-11 spacecraft. Other awards included the AMSAT-Stoner 25th Anniversary Challenge Cup to grand prize winner Nick Laub, W0CA. The cup, a silver champagne bucket on a walnut base standing nearly 2-ft. tall, was presented by Don Stoner, W6TNS. It had been Don who 25 years earlier had openly mused about amateurs launching their own satellite.

An award was presented in absentia to Rich Zwirko, K1HTV, honoring him for his many years of service as both an AMSAT Director and Vice President for Operations. Awards announced at the meeting include the Sherman Memorial Satellite Public Service Award and the AMSAT Technical Achievement Award. Both will be awarded for the first time in 1985. Julian McCassey received a special award from AMSAT recognizing his fund-raising activities in the Los Angeles area that resulted in donations of nearly \$2000.

Digital conference calls for papers . . .

The American Radio Relay League has issued a call for papers for its Fourth Amateur Radio Computer Networking Conference scheduled for March 30, 1985 in San Francisco, CA. The conference will be held on the first day of the West Coast Computer Faire, which runs from March 30 through April 2.

Technical papers are requested on all aspects of amateur packet radio and other forms of digital commu-

by Martin Davidoff, K2UBC*

nifications via terrestrial, ionospheric, meteor-scatter, and satellite media, including AMSAT-OSCAR-10 and the planned PACSAT. Topics suggested include network and system architecture, proposed standards, hardware, software, protocols, modulation and encoding schemes, applications, as well as practical experience.

The deadline for receipt of camera-ready papers is March 1, 1985. They should be mailed to Marian S. Anderson, WB1FSB, American Radio Relay League, 225 Main St., Newington, CT 06111. Those planning to present a paper should request an author's kit and should immediately inform the ARRL of the title of the manuscript. Proceedings will be sold at the conference and by mail from the ARRL headquarters.

Mystery Satellite No Longer Unidentified

Thanks to some fine satellite-sleuthing by W4HHK, WB5LUA and Mr. Dick Flagg of Florida, the so-called "mystery" satellite which has been tearing up the EMEers on the 13-cm band has been identified. According to Flagg, a member of the Kettering Group, a small satellite-interest group with members spread across the globe, the mystery satellite is not one but two new Russian early warning satellites. As reported earlier, Cosmos 1217 had been identified as having been transmitting on 2304 MHz. The new satellites have been identified as catalog numbers 84-033A (Cosmos 1547) and 84-107A (Cosmos 1604??). Also, as was noted earlier, the 13-cm ham band is primarily allocated to "radiolocation" with amateur operation secondary. Thus there appears little constructive amateurs can do to dispose of the "intruders." On the other hand, as pointed out by Bob Atkins, KA1GT, the identification of those satellites and the predictability of their passage in the Molniya orbit they apparently use suggest their use to amateurs as beacons and alignment tools for both active electronics and mechanical hardware such as dish mounts, feed horns, and the like.

Flurry of Appointments Follows Board Meeting

Following the AMSAT Board of Directors meeting, a series of appointments was announced by AMSAT headquarters. Jim McKim, W0CY, formerly Chief U.S. Area Coordinator has been promoted Assistant Vice President, Operations (AVP/O) for Administration. Jack Somers, WA6VGS, formerly Deputy Chief U.S. Area Coordinator has been elevated to the Chief Area Coordinator slot. Within the Engineering group, three Assistant Vice Presidents were reappointed: Harold Price, NK6K (AVP/E-PACSAT); Phil Karn, KA9Q, (AVP/E-Systems), and Steve Robinson, W2FPY (AVP/E-R&D).

In related appointments, the following Area Coordinators were recently named: Andy Deskur, KA1M (Eastern and Mid Massachusetts and Southern New Hampshire); Tom Wrenach, N9HR, additional AC for the Milwaukee area; Ramon Traver, WA2LJM, Southern New York; Dave Kifer, N8ETY, Northeast Ohio replacing WB8CQW who's retiring for health reasons; Larry Koziel, K8MU, for Michigan replacing the retiring veteran Dick Cotton, W8DX, who put in many years of dedicated service to AMSAT. Also announced was a new Special Legal Counsel, Kevin Peterson, W8GQ.

Briefs

The North American Teleconference Net, featuring packeteers Lyle Johnson, WA7GXD, and Harold Price, NK6K, aired Dec. 2 to an estimated 20 to 50 thousand hams around the world. The transmission was carried in real-time aboard AO-10 on Special Service Channel H2.

AMSAT welcomes a new Net Control Station aboard. Dave Cowdin, WD0HHU, of Colorado made his 15/20-meter net debut on Dec. 2. He'll join Bob McGwier, N4HY, in the International Net Sundays.

A few months ago, I talked with AMSAT General Manager Bill Lazzaro, N2CF, about the major changes being considered for *Orbit* magazine. As an information junkie, I pushed for a simpler format, figuring that it would reduce the chore of putting *Orbit* together and permit a more frequent publishing schedule. Bill asked if I would be willing to back up my opinion by preparing a column on a regular basis. Like many of you, I consider time an extremely precious commodity—my commitments always seem to be in excess of 24 hours per day. But, I felt that this was an important issue so I agreed.

In late 1969, spending my fifth winter in the snows of Syracuse, New York, I read in the pages of *QST* about a new organization, located in the Washington, DC area, called AMSAT. The group was working to obtain a launch for OSCAR-5 and planning to build future radio amateur satellites. I sent them a check for \$5.00 (yes, \$5.00!) for a subscription to the *AMSAT Newsletter*. I didn't think of my payment as a donation. As a graduate student I was pretty stingy about contributions. The subscription was to feed my addiction to technical information. Whenever the quarterly newsletter showed up in the mail, with its typewritten text and hand-drawn figures, everything else was set aside until it was read. I was hooked. After a few years, I became accustomed to a slightly erratic publishing schedule and, when the newsletter arrived only a month late, you couldn't help but feel it was actually early. Seriously, though the info addicts, this writer included, always wanted more information and wanted it more quickly, the volunteer editors did an excellent job of getting the word out. The editors of the *AMSAT Newsletter* included Sajjad Durrani (1969-1970); Bob Clark WB4SMH (1970-1972); Tom Mitchell, WA3TBD (1973-1974); (Continued next page)

(Continued from previous page)

and Joe Kasser, G3ZCZ (1974-1979). *Orbit* editors have been Joe Kasser, G3ZCZ (1980-1981); Vern Riportella, WA2LQQ (1981-1983); and Harold Winard, KB2M (1983-1984).

In 1981, the AMSAT Newsletter

was replaced by a typeset, large-format, multicolor publication—*Orbit*. Although *Orbit* improved on the quarterly publication rate of the newsletter, and substantially increased the amount of technical and operational material published, it encountered several problems. First, as most now real-

ize, the cost, in dollars and in person-hours of work, was higher than anticipated. Second, new members and potential new members, who had never seen the old newsletter, were apt to compare *Orbit* to *QST* and other commercial magazines instead of to the previous AMSAT publications. It was a bad situation; as a volunteer organization we can't compete in that league.

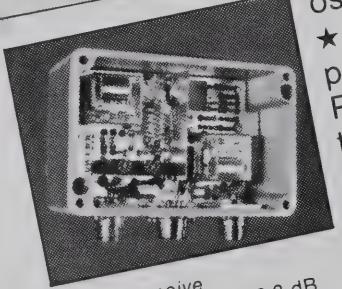
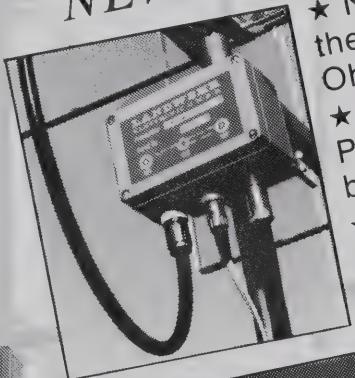
Over the past year, several informal polls of the membership have shown that the majority prefer that AMSAT switch to a more modest format for its major magazine if such a change results in a higher frequency of publication and an increase in total material presented. The preference is not unanimous. We hope that those of you who voted to maintain the old *Orbit* will try to understand the situation and give the new format a chance—if it doesn't work, we'll try something else. A statement in an old advertisement encouraging readers to join the North Star Computer Users Group keeps popping to my mind—membership entitles you to a quarterly publication that comes out occasionally. Finished with publications.

A pile of index cards has already started to accumulate in the back of my desk drawer. Each one contains a possible topic for a future column. For example: Electronics—the search for plans of an easy-to-build, high-performance 2-meter preamplifier . . . Tracking—how often should those using computers to track OSCAR-10 update orbital elements and is there any need for a version of the W3IWI tracking program in structured BASIC or Turbo Pascal for the IBM PC? . . . Informational—a guide to specialized publications in the areas of VHF/UHF communication, weather satellites, satellite TV, etc. . . . Organizational—can we eventually afford a Phase IV geostationary satellite system and do we want such a system if we can afford it?

By the way, the opinions expressed in this column are entirely those of the author, who has been known to put his foot in his mouth all too often.

THIS IS IT! ...an affordable high quality masthead preamplifier

HEAR SIGNALS THAT YOU'VE NEVER HEARD BEFORE



SPECIFICATIONS:

Noise figure Receive 0.8 dB
Gain 18-20 dB

Transmit
Switchable power (VOX) 150 W
Max TX power (PTT) 750 W PEP

Prices subject to change without notice
★ The price...only
\$179.00

the Landwehr masthead preamplifier, available only from Henry Radio
...in fact, we have it all... We are OSCAR specialists. Henry
Radio leads the way. Let us answer your questions. Henry
help you with your needs. Give us a call — at the L.A. store
ask for Jack (WA6VGS).

Henry Radio

(213) 820-1234
(714) 772-9200

2050 S. Bundy Dr., Los Angeles, CA 90025
931 N. Euclid, Anaheim, CA 92801

TOLL FREE ORDER NUMBER: (800) 421-6631
For all states except California.
Calif. residents please call collect on our regular numbers.

*13803 Manor Glen Road
Baldwin, MD 21013

AMSAT- OSCAR-10

RTTY Format

On September 3, 1984 a new beacon system was implemented on AMSAT-OSCAR-10 that for the first time included a radio teletypewriter, or RTTY transmission. That signal contains key spacecraft operating conditions encoded in a format convenient for those radio amateurs not equipped with the phase-shift keyed (PSK) decoders used by command stations. Here's how to decode the RTTY telemetry being heard on Mode B at 15 and 45 minutes past the hour and on Mode L at 0, 15, and 30 minutes past the hour. There are four beacons on AMSAT-OSCAR 10:

Mode B General Beacon: 145.810 MHz

Mode B Engineering Beacon: 145.987 MHz

Mode L General Beacon: 436.020 MHz

Mode L Engineering Beacon: 436.040 MHz

Currently the Mode-B General Beacon and the Mode-L Engineering Beacon are in use. Listen for the RTTY telemetry there.

According to command station VE1SAT/VE6, the so-called "Z" block sent in RTTY form is a version of the "Y" block telemetry send via PSK. Thus many of the key operating parameters are now available for reception and decoding by anyone with 45-baud Baudot RTTY demodulation and display capability.

The exact rate is 50 bauds rather than the 45-baud (60-wpm) standard. However, most electronic

and mechanical machines equipped to receive 45 bauds will respond well to 50 bauds. The AO-10 RTTY telemetry is sent in frequency-shift keying (FSK) with a 170-Hz shift and is encoded in the standard 5-level Baudot format.

The table below illustrates the RTTY format as seen on an RTTY machine or computer video display. The telemetry channels will appear as six rows (lines) of ten columns.

According to command station ZL1AOX, each of the 60 telemetry cells or channels is sent as a 1-, 2-, or 3-character numeric group, for example, "1", "16" or "165". The entire sequence begins with an identification, such as:

HI HI THIS IS AMSAT OSCAR 10

That is followed by the Universal Coordinated Time (UTC) in the standard HH:MM:SS format. Next is the AMSAT day number, where day 1 equals 1 Jan 78. That is followed by three hexadecimal numbers denoting safety information, transponder status, and command serial number. Next are seven decimal numbers that indicate the Internal Housekeeping Unit (IHU) multiplexer status. The block of 60 telemetry channels then follows four blank lines.

	1	2	3	4	5	6	7	8	9	10
A										
B										
C										
D										
E										
F										

Tlm Row/ Col	Meaning	Equation	Units
A1	Solar panel out and BCR input voltage	$n*150$	mV
A2	70-cm transmitter average power output	$(253-n)^2/2000$	W
A3	70-cm receiver temperature	$(n-127)/1.82$	C
A4	Nutation damper temperature	$(n-127)/1.82$	C
A5	BCR output and main battery voltage	$(n-10)*75$	mV
A6	Special purpose	xxxxxxxxxxxx	-
A7	2-m transmitter temperature	$(n-127)/1.82$	C
A8	14-V rail current to transponder	$(n-15)*20.64$	mA
A9	10-V regulator voltage	$(n-12)*50$	mV
A10	He tank pressure at high pressure regulator	$(n-34)*44.46$	bar
B1	IHU temperature	$(n-127)/1.82$	C
B2	14-V rail current to magnetorquers and antenna relay	$(n-15)*4.128$	mA
B3	BCR #1 status	$0 = \text{Off}, N > 10 = \text{On}$	-
B4	He tank pressure at low pressure regulator	$(n-37)*0.8$	bar
B5	BCR temperature	$(n-127)/1.82$	C
B6	10-V regulator current	$(n-15)*4.128$	mA
B7	BCR #2 status	$0 = \text{Off}, N > 10 = \text{On}$	-
B8	Not used	xxxxxxxxxxxx	-
B9	SEU temperature	$(n-127)/1.82$	C
B10	Battery charge current	$(n-15)*10.32$	mA

Tlm Row/ Col	Meaning	Equation	Units
C1	Top photocell sensor	65 means sun normal to Z (spin) axis; 20-30 nominal	-
C2	Special purpose	xxxxxxxxxxxx	-
C3	Main battery case #1 temperature	(n-127)/1.82	C
C4	Active BCR output current	(n-15)*20.64	mA
C5	Bottom photocell sensor	(same as C1)	-
C6	Kick motor strut temperature	(Inoperative)	-
C7	Main battery case #2 temperature	(n-127)/1.82	C
C8	Active BCR input current on 28-V line	(n-15)*10.32	mA
C9	Spin rate	if n<139 or if n>= 139 if n<100 or if n>= 100 r=(139-n)*0.8+20 r=508/(n-116)-2 AGC=0 AGC=(n-100)^2/189	rpm rpm dB dB
C10	24-cm receiver AGC		
D1	Auxillary battery temperature	(n-127)/1.82	C
D2	Solar panel #6 current	(n-15)*4.128	mA
D3	2-meter transmitter average power output	(200-n)^2/2000	W
D4	He tank temperature	(n-127)/1.82	C
D5	Solar panel #1 temperature	(n-127)/1.82	C
D6	Solar panel #5 current	(n-15)*4.128	mA
D7	70-cm receiver AGC	(n-83)^2/1000	dB
D8	70-cm transmitter temperature	(n-127)/1.82	C
D9	Solar panel #3 temperature	(n-127)/1.82	C
D10	Solar panel #4 current	(n-15)*4.128	mA
E1	Special purpose	xxxxxxxxxxxx	-
E2	24-cm receiver temperature	(n-127)/1.82	C
E3	Solar panel #5 temperature	(n-127)/1.82	C
E4	Solar panel #3 current	(n-15)*4.128	mA
E5	14-V regulator voltage	(n-10)*61.5	mV
E6	Wall temperature in arm #3	(n-127)/1.82	C
E7	Top surface temperature of arm #1	(n-127)/1.82	C
E8	Solar panel #2 current	(n-15)*4.128	mA
E9	Internal 9-V bus from transponder	(n-10)*50	mV
E10	Wall temperature in arm #2	(n-127)/1.82	C
F1	Bottom surface temperature of arm #1	(n-127)/1.82	C
F2	Solar panel #1 current	(n-15)*4.128	mA
F3	Special purpose	xxxxxxxxxxxx	-
F4	Wall temperature in arm #1	(n-127)/1.82	C
F5	N ₂ O ₄ tank temperature	(n-127)/1.82	C
F6	UDMH tank temperature	(n-127)/1.82	C
F7	Auxillary battery voltage	(n-10)*75	mV
F8	Central support cylinder temperature near arm #1	(n-127)/1.82	C
F9	Earth sensor temperature	(n-127)/1.82	C
F10	Mode L transponder 9-V regulated line	(n-10)*44	mV

B1: IHU = Integrated Housekeeping Unit—the computer

B3: BCR = Battery Charge Regulator

B4: He = Helium

B9: SEU = Sensor Electronics Unit

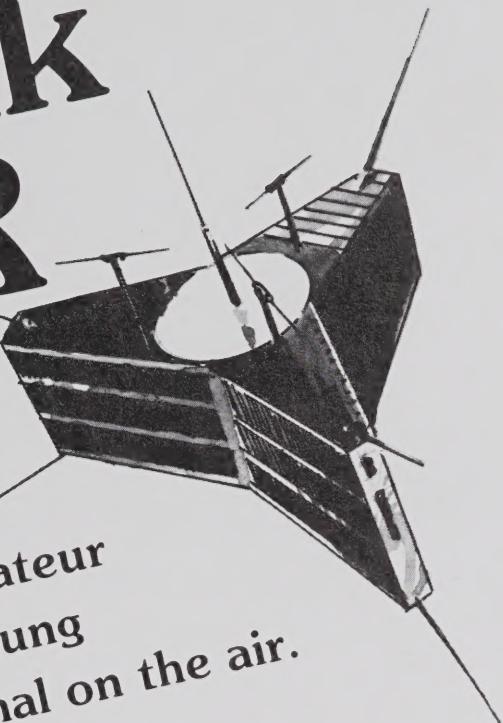
C8: Direct from solar panels

F5: N₂O₄ is nitrogen tetroxide—the propellant oxidizer

F6: UDMH is unsymmetrical di-methyl hydrazine—the propellant fuel

We talk OSCAR

...at Henry Radio we're dedicated to
every aspect of amateur radio from
the exciting and sophisticated
technology of today's amateur
satellites to helping the young
novice get his first signal on the air.



★ TRANCEIVERS FOR OSCAR

- ICOM
- KENWOOD
- TEN-TEC
- YASEU

★ ASTRON POWER SUPPLIES

★ LINEAR AMPS

★ AZMUTH & ELEVATION ROTORS

★ GaAsFET RECEIVING PREAMPS

★ STANDARD

★ MAST MOUNTED

★ L & R HAND CIRCULAR POLARIZED ANTENNAS

★ ORBIT PLOTTERS

★ ORBIT MAGAZINE

★ AMSAT BADGES

★ BELDEN 9913 COAX

★ ORBIT CALENDARS

We have it all...we are OSCAR specialists. Henry Radio leads the way. Let us
answer your questions and help you with your needs. Give us a call. At the L.A. store
ask for Jack (WA6VGS).



Henry Radio

2050 S. Bundy Dr., Los Angeles, CA 90025
131 N. Euclid, Anaheim, CA 92801

(213) 820-1234
(714) 772-9200

TOLL FREE ORDER NUMBER: (800) 421-6631
For all states except California.

California residents please call collect on our regular numbers.

KENWOOD

...pacesetter in amateur radio

TR-9130

TR-9130 2 meter all mode

The TR-9130 is a compact rig that gives you 25 watts of RF power on all modes!! You can select your tuning steps from 100-Hz, 1-kHz, 5-kHz or 10-kHz. With six memories, you can program your favorite frequencies! (FM 1-5 Simplex or \pm 600-kHz offset, memory 6 non-standard offset, all six for simplex, any mode!) Dual

digital VFO's, and transmit frequency tuning enhance OSCAR operations.

Internal battery back-up (9 V Ni-Cd not Kenwood supplied) retains memories for approximately 24 hours, in case you operate mobile and base!

Other convenient features such as automatic band scan, squelch circuit for FM/SSB/CW,



tone switch, repeater reverse switch, CW semi break-in; sidetone, high performance noise blanker HI (25) LOW (5) power switch (FM/CW) RF gain control, and RIT circuit further enhance this expressive package!

Optional accessories:

- KPS-7A AC power supply.
- PS-20 AC power supply (TR-9500 only).
- BO-9A system base with memory back-up supply.

- SP-120 external speaker.
- TK-1 AC adapter for memory back-up.
- SP-40 mobile speaker.
- SP-50 mobile speaker.
- SW-100 A/B power meters.
- MC-55 Mobile Mic w/time-out timer.



TR-9500

70 CM SSB/CW/FM transceiver

- Covers 430-440 MHz, in steps of 100-Hz, 1-kHz, 5-kHz, 25-kHz or 1-MHz.
- CW-FM Hi—10 W, Low—1 W. SSB 10 W.
- Automatic band/memory scan. Search of selected 10-kHz segments on SSB/CW.
- 6 memory channels.

TS-711A/TS-811A

Multi-function all-mode 2 m and 70 cm transceivers.

The TS-711A 2 m (142-149 MHz) and TS-811A 70 cm (430-450 MHz) all-mode transceivers are perfect base station units, designed to complement your present HF station. Both feature Kenwood's innovative D.C.S. circuitry. Built-in dual digital VFO's provide commercial-grade frequency stability through the

use of a TCXO (Temperature Compensated Crystal Oscillator). The new fluorescent multi-function display shows frequency, RIT shift, VFO A/B, SPLIT, ALERT, repeater offset, digital code, call sign code, and memory channel. 40 multi-function memories store frequency, mode, repeater offset and tone. They have programmable scan, memory scan, and mode scan. The Auto-mode

function automatically selects the correct mode for the frequency being used. When a mode key is depressed, an audible "beeper" announces mode identification in International Morse Code.

The TS-711A/TS-811A also feature all-mode squelch, noise blanker, speech processor (SSB, FM), IF shift, RF power control, alert, and a unique channel Quick-Step tuning that varies tuning characteristics from conventional VFO feel, to stepping action when CH.Q switch is

depressed.

Combine all these features with built-in AC power supply and a hefty 25 watts RF output power and you have your ideal base station.

Optional accessories:

- CD-10 Call sign Display
- TU-5 CTCSS Tone Unit • VS-1 Voice Synthesizer • MC-60A Deluxe Desk Mic • MC-80 Desk Mic • MC-85 Desk Mic
- SP-430 External Speakers
- MB-430 Mobile Mount
- PG-2J DC Cable

